MECH2005

Engineering Materials

Session 2, In person-scheduled-weekday, North Ryde 2026

School of Engineering

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General Information

Unit convenor and teaching staff
Unit convenor
Peggy Qi Zhang
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Contact via Email
Rm297, Level 2, 9WW, School of Engineering
Appointment by email

Credit points
10

Prerequisites
MECH1001

Corequisites

Co-badged status

Unit description
The purpose of this unit is to develop an understanding and insight into the design and utilisation of engineering materials. Students will develop knowledge of the mechanical properties of different materials in relations to the physical and chemical phenomenon. Topics covered in this unit will include physical and chemical nature of materials, the effects of nano-, micro- and macro- structures in material properties, considerations in modifying mechanical properties in metallic systems, composite design and materials selection.

Learning in this unit enhances student understanding of global challenges identified by the United Nations Sustainable Development Goals (UNSDGs) Industry, Innovation and Infrastructure

Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at https://www.mq.edu.au/study/calendar-of-dates

Learning Outcomes

On successful completion of this unit, you will be able to:

ULO1: Classify primary engineering materials and their major applications, and demonstrate knowledge of how materials are structured based on the arrangement of atoms.

ULO2: Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.
ULO3: Evaluate the mechanical properties of different engineering materials and their limitations, and will be able to account for the observed features of a stress-strain curve.
ULO4: Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as wel as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.
ULO5: Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength, toughness, and/or durability.
ULO6: Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

General Assessment Information

Grading and passing requirements for this unit
To pass this unit, a student must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD).
Please refer to the policies and procedures section below for further details about grading.

Late assessment submission penalties
The late submission policies adopted in this unit are in line with the general faculty's policy on assessment submission deadlines, including late submissions.
Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark of the task) will be applied for each day, for an assignment that is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. The submission time for all uploaded assessments is 11:55 pm. A 1-hour grace period will be provided to students who experience a technical concern. For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, please apply for Special Consideration.

Special consideration for the final exam
If you receive special consideration for the final exam, a supplementary exam will be scheduled by the faculty during a supplementary exam period, typically about 3 to 4 weeks after the normal

exam period. By making a special consideration application for the final exam, you declare yourself available for a resit during the supplementary examination period, and you will not be eligible for a second special consideration approval based on pre-existing commitments. Please ensure you are familiar with the policy prior to submitting an application. Approved applicants will receive an individual notification one week prior to the exam with their supplementary examination's exact date and time.

Assessment Tasks

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Assignment	30%	No	13/09/2026	Individual	Yes	Open
Assignment	35%	No	30/10/2026	Individual	Yes	Open
Final Exam	35%	No	Exam Period	Individual	No	Observed

Assignment

Assessment Type [1]: Written Submission
Indicative Time on Task [2]: 20 hours
Due: **13/09/2026**
Weighting: **30%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

This assignment is designed to enhance students' understanding of the unit content.

On successful completion you will be able to:

- Classify primary engineering materials and their major applications, and demonstrate knowledge of how materials are structured based on the arrangement of atoms.
- Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.
- Evaluate the mechanical properties of different engineering materials and their limitations, and will be able to account for the observed features of a stress-strain curve.
- Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as wel as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.
- Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength,

toughness, and/or durability.
- Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

Assignment

Assessment Type [1]: Problem-based task
Indicative Time on Task [2]: 35 hours
Due: **30/10/2026**
Weighting: **35%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

Students will reflect upon, and solve, a suite of problems over time demonstrating their knowledge and skill in relation to content covered from week 2 to week 10.

On successful completion you will be able to:
- Classify primary engineering materials and their major applications, and demonstrate knowledge of how materials are structured based on the arrangement of atoms.
- Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.
- Evaluate the mechanical properties of different engineering materials and their limitations, and will be able to account for the observed features of a stress-strain curve.
- Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as wel as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.
- Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength, toughness, and/or durability.
- Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 33 hours

Due: **Exam Period**
Weighting: **35%**
Groupwork/Individual: Individual
Short extension [3]: No
AI Approach: Observed

You will undertake a final examination during the formal examination period.

On successful completion you will be able to:

- Classify primary engineering materials and their major applications, and demonstrate knowledge of how materials are structured based on the arrangement of atoms.
- Demonstrate essential engineering skills in interpreting phase diagrams and identifying possible phase transformations under different scenarios, on the basis of binary phase diagrams.
- Evaluate the mechanical properties of different engineering materials and their limitations, and will be able to account for the observed features of a stress-strain curve.
- Demonstrate in-depth knowledge of strengthening mechanisms in metallic materials, including work hardening, grain boundary strengthening, solution strengthening, and precipitation hardening, as wel as knowledge of microstructure-mechanical property relationships and essential methodology in microstructural control.
- Demonstrate essential knowledge of and skills in materials selection in mechanical design, and select materials that best fit the design demands of stiffness, strength, toughness, and/or durability.
- Demonstrate fundamental knowledge about semiconductors and nanomaterials to effectively design semiconductor and nanostructure-based devices that can meet specific demands such as conductivity, resistivity, and durability, among others.

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[1] If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- Academic Success for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation.

[3] An automatic short extension is available for some assessments. Apply through the Service Connect Portal.

Delivery and Resources

Textbook

The unit covers the majority of the content in Materials Science and Engineering: An Introduction, 10th Australia and New Zealand Edition, (William D. Callister). It is not mandatory to purchase the textbook, but students are encouraged to own a copy of the textbook.

Running of Lectures and SGTAs (tutorials) in Week 1

The lectures start from Week 1. All lectures are online. Please see iLearn page for Zoom link.

There are no SGTAs (tutorials) in Week 1.

On-campus activities

The On-campus activities are the weekly SGTAs (from Week 2).

Students must contact the convenor and TAs as soon as possible if they are unable to attend the On-campus activities.

Technology used

Students will be introduced to a range of engineering apparatuses used to demonstrate tensile testing on different materials. Selected specimens will then undergo post-treatment processes such as cutting, mounting, and polishing in preparation for microstructural investigation using a Scanning Electron Microscope (SEM).

Students will observe the operation of the tensile testing machine and learn how mechanical data are collected for stress–strain curve analysis. They will also observe demonstrations of cutting, mounting and polishing specimens. Finally, students will be introduced to how SEM is used to examine the microstructure of materials.

Methods of Communication

We will communicate with students via your university email or through announcements on iLearn.

Queries to convenors can either be placed on the iLearn discussion board or sent to any of the teaching staff from your university email address.

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (https://policies.mq.edu.au). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- Academic Appeals Policy
- Academic Integrity Policy
- Academic Progression Policy
- Assessment Policy

- Fitness to Practice Procedure
- Assessment Procedure
- Complaints Resolution Procedure for Students and Members of the Public
- Special Consideration Policy

Students seeking more policy resources can visit Student Policies (https://students.mq.edu.au/support/study/policies). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit Policy Central (https://policies.mq.edu.au) and use the search tool.

Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: https://students.mq.edu.au/admin/other-resources/student-conduct

Results

Results published on platform other than eStudent, (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the University. Once approved, final results will be sent to your student email address and will be made available in eStudent. For more information visit connect.mq.edu.au or if you are a Global MBA student contact globalmba.support@mq.edu.au

Academic Integrity

At Macquarie, we believe academic integrity – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free online writing and maths support, academic skills development and wellbeing consultations.

Student Support

Macquarie University provides a range of support services for students. For details, visit http://students.mq.edu.au/support/

Academic Success

Academic Success provides resources to develop your English language proficiency, academic writing, and communication skills.

- Ask a Study Coach
- Access StudyWISE
- Upload an assignment to Studiosity
- Complete the Academic Integrity Module

The Library provides online and face to face support to help you find and use relevant information resources.

- Subject and Research Guides
- Ask a Librarian

Student Services and Support

Macquarie University offers a range of Student Support Services including:

- IT Support
- Accessibility and disability support with study
- Mental health support
- Safety support to respond to bullying, harassment, sexual harassment and sexual assault
- Social support including information about finances, tenancy and legal issues
- Student Advocacy provides independent advice on MQ policies, procedures, and processes

Student Enquiries

Got a question? Ask us via the Service Connect Portal, or contact Service Connect.

IT Help

For help with University computer systems and technology, visit https://students.mq.edu.au/support/technology/service-desk.

When using the University's IT, you must adhere to the Acceptable Use of IT Resources Policy. The policy applies to all who connect to the MQ network including students.

Engineer Australia Competency Standard

Engineers Australia Competency Standard	Competency	Unit Learning Outcomes
Knowledge and Skill Base	**1.1** Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	**1,2,3,4,5,6**
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	**2,3,4**
	1.3 In-depth understanding of specialist bodies of knowledge.	**1,2,3,4,5,6**
	1.4 Discernment of knowledge development and research directions.	**1,2,3,4,5,6**
	1.5 Knowledge of engineering design practice.	**3,4,5,6**
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	**1,2,3,4,5,6**
Engineering Application Ability	**2.1** Application of established engineering methods to complex problem solving.	**1,2,3,4,5,6**

Engineers Australia Competency Standard	Competency	Unit Learning Outcomes
	2.2 Fluent application of engineering techniques, tools and resources.	**1,2,3,4,5,6**
	2.3 Application of systematic engineering synthesis and design processes.	**4,5,6**
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	**5**
Professional and Personal Attributes	**3.1** Ethical conduct and professional accountability.	**1,2,3,4,5,6**
	3.2 Effective oral and written communication in professional and lay domains.	**1,2,3,4,5,6**
	3.3 Creative, innovative and pro-active demeanour.	**5,6**
	3.4 Professional use and management of information.	**1,2,3,4,5,6**
	3.5 Orderly management of self, and professional conduct.	**3,5**
	3.6 Effective team membership and team leadership.	**1,3,5**

Unit information based on version 2026.02 of the Handbook